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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,386	10/31/2003	Mohammad Jaber Borran	873.0130.U1(US)	2899

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EXAMINER	
ODOM, CURTIS B	

ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 06/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/699,386	BORRAN ET AL.	
	Examiner	Art Unit	
	Curtis B. Odom	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16 and 19-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15,19,20,21, 23 and 24* is/are rejected.

7)☒ Claim(s) *16, ,22 and 25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The amendments filed 5/15/2006 have been entered and based on the new grounds of rejection the finality of the Office Action data 3/20/2006 has been withdrawn.

Response to Arguments

2. Regarding claims 1-12, the applicant refers to MPEP 2106 which states: "Data structures not claimed as embodied in computer-readable media are descriptive material per se and are not statutory because they are not capable of causing functional change in the computer. See, e.g., Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory). Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized, and is thus statutory".

Regarding claims 1-12, even though the claims recite a data structure (signal constellation) stored on a computer readable medium, the claim is still silent as to structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized. The constellation is stored on the computer readable medium, but the claim is silent as to how the constellation is

encoded on the medium to allow structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized. Thus, the claim simply recites non-statutory subject matter (signal constellation) stored in a storage medium. Since the storage medium alone does not provide functionality, claims 1-12 stand rejected.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 1-12 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Amended claims 1-12 are still directed towards a signal constellation which is simply a data signal. Note this data signal merely consists of "1" and "0" to represent the coded signal. It does not fall under the category or a method, apparatus, product, or composition of matter. The signal falls into the category of Nonfunctional Descriptive Material. See for example MPEP § 2106 IV.B.1. (b) which states that

> The policy that precludes the patenting of nonfunctional descriptive material would be easily frustrated if the same descriptive material could be patented when claimed as an article of manufacture. For example, music is commonly sold to consumers in the format of a compact disc. In such cases, the known compact disc acts as nothing more than a carrier for nonfunctional descriptive material. The purely nonfunctional descriptive material cannot alone provide the practical application for the manufacture.

The signal is functionally equivalent to the compact disc in that it is nothing more than a carrier for nonfunctional descriptive material (1's and 0's). The nonfunctional material, or the signal for that fact, cannot alone provide the practical application for the manufacture. Without a

communications device, the signal is nonfunctional, it produces or manufactures nothing. Thus, a claim directed toward a signal is deemed non-statutory subject matter.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 13, 14, 19, 20, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al. (U. S. Patent No. 6, 654, 431) in view of Schill (EP 1 324 558 A1) and in further view of Walker et al. (US 2003/0076889).

Regarding claim 13, Barton et al. discloses a transmitter comprising:

a table (column 9, lines 35-51) for storing a multi-level signal constellation defining C points;

a modulator representing a mapper (Fig. 3, block 320, column 9, lines 25-51) coupled to the storage medium for converting an input signal to a plurality of data symbols that each correspond to at least one of the constellation points;

a pilot circuit (Fig. 3, block 330, column 12, lines 18-20) for outputting pilot symbols;

an IDFT circuit representing a modulator (Fig. 3, block 340, column 8, lines 42-64) having an input coupled to an output of the mapper and to an output of the pilot circuit for

modulating the data symbols and the pilot symbols in accordance with an OFDM transmission technique; and

using antenna diversity to improve performance comprising of at least two branches (antennas) (column 13, lines 38-50) coupled to an output of the modulator for simultaneously transmitting the modulated symbols.

Barton et al. does not disclose the constellation includes points, one of which at defines a first level and a plurality of points define a second level, and a minimum inter-level distance between points is based on a maximized minimum difference between conditional probability distributions.

However, Schill discloses creating a constellation comprising of subclusters of points wherein the subclusters of points are mapped to different mapping levels (sections 0049 and 0055), wherein the distance between each subcluster of points is based on a distance between conditional probability distributions assigned to the set of subclusters (sections 0058-0059). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the device of Barton et al. by the teachings of Schill to apply probability distributions to subclusters of different levels of the constellation since Schill states this process can increase performance at the receiver.

Walker et al. further discloses maximizing a minimum distance between constellation points (section 0031). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to maximize a minimum distance between the points of subclusters of different levels of Barton et al. and Schill as taught by Walker et al. since Walker et al. states

maximizing a minimum distance between constellation points improves bit error probability (section 0031).

Regarding claim 14, Barton discloses a receiver (Fig. 10) for receiving data and pilot symbols simultaneously over multiple OFDM channels comprising:

at least one branch (antenna) to receive a transmitted signal (column 13, lines 37-50);

a DFT circuit representing a demodulator (Fig. 10, block 430, column 4, lines 47-54) coupled to an output of the antenna for demodulating received symbols in accordance with an OFDM transmission technique,

a channel estimator (Fig. 10, block 435, column 16, line 66-column 17, line 22) coupled to the demodulator for estimating a channel of a OFDM system using received pilot symbols;

a table (column 18, lines 46-67) for storing a multi-level signal constellation defining C points;

a demodulator representing demapper (Fig. 10, block 460, column 18, lines 46-67) coupled to the demodulator and to the storage medium for converting the demodulated symbols to a plurality of data signals that each alone or in combination correspond to a constellation point based on the table stored in the demodulator.

Barton et al. does not disclose the constellation includes points, one of which at defines a first level and a plurality of points define a second level, and a minimum inter-level distance between points is based on a maximized minimum difference between conditional probability distributions.

However, Schill discloses creating a constellation comprising of subclusters of points wherein the subclusters of points are mapped to different mapping levels (sections 0049 and 0055), wherein the distance between each subcluster of points is based on a distance between conditional probability distributions assigned to the set of subclusters (sections 0058-0059). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the device of Barton et al. by the teachings of Schill to apply probability distributions to subclusters of different levels of the constellation since Schill states this process can increase performance at the receiver.

Walker et al. further discloses maximizing a minimum distance between constellation points (section 0031). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to maximize a minimum distance between the points of subclusters of different levels of Barton et al. and Schill as taught by Walker et al. since Walker et al. states maximizing a minimum distance between constellation points improves bit error probability (section 0031).

Regarding claim 19, Walker et al. discloses a method for decoding a signal received over a multi-carrier system comprising:

receiving (column 13, lines 37-50) a set of signals that were transmitted from at least M transmit antenna branches using antenna diversity from a OFDM channel, wherein M is an integer at least equal to two;

using a pilot symbols Fig. 10, block 435, column 16, line 66-column 17, line 22) of the set of signals to estimate channels of the multi-carrier system; and

decoding (column 18, lines 42-64) using a demodulator at least a portion of the set of signals by mapping them to a signal constellation.

Barton et al. does not disclose the signal constellation defining a plurality of C constellation points and n=2M real dimensions, wherein the C points are disposed about at least two mutually exclusive subsets such that a separation between two nearest constellation points of adjacent subsets is based on a maximized minimum difference between conditional probability distributions.

However, Schill discloses creating a constellation comprising of subclusters of points wherein the subclusters of points represent mutually exclusive subsets of points (section 0049) and are mapped to different mapping levels (section 0055), wherein the distance between each subcluster of points is based on a distance between conditional probability distributions assigned to the set of subclusters (sections 0058-0059). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the device of Barton et al. by the teachings of Schill to apply probability distributions to subclusters of different levels of the constellation since Schill states this process can increase performance at the receiver.

Walker et al. further discloses maximizing a minimum distance between constellation points (section 0031). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to maximize a minimum distance between the points of subclusters of different levels of Barton et al. and Schill as taught by Walker et al. since Walker et al. states maximizing a minimum distance between constellation points improves bit error probability (section 0031).

Regarding claim 20, Barton et al. further discloses decoding (demodulating) the set of signals comprises separately determining which point of the constellation a particular symbol within the set of demodulated signals best matches (column 13, lines 53-64).

Regarding claim 23, Walker et al. further discloses maximizing a minimum difference between constellation points produces mutually exclusive rings representing subsets of points which define a concentric sphere (see Fig. 2 and 3, sections 0022-0030). It would have been obvious to include this feature since Walker et al. states maximizing a minimum distance between constellation points improves bit error probability (section 0031).

Regarding claim 24, Schill further discloses mapping at least a portion of the set of signals to the signal constellation comprises determining a conditional probability distribution represented as shaping information (see section 0059) of each symbol (data block) within the set of signals (section 0079-0084). It would have been obvious to include this feature since Schill discloses using shaping information can increase performance at the receiver.

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al. (U. S. Patent No. 6, 654, 431) in view of Schill (EP 1 324 558 A1) in further view of Walker et al. (US 2003/0076889) as applied to claim 14, and in further view of Chiasson et al. (U. S. Patent No. 5, 608, 763).

Regarding claim 15, Barton et al., Schill, and Walker et al. disclose all the limitations of claim 15, including a demodulator (decoder) demodulator for determining shaping information (section 0079-0084) representative of a conditional probability distribution (see section 0059) of the received symbols in the constellation. Barton et al., Schill, and Walker et al. do not disclose maximum likelihood demodulation.

However, Chiasson et al. discloses maximum likelihood decoding involving a maximum likelihood conditional probability distribution (PDF) of a received signal (column 2, line 59-column 3, line 21). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the receiver of Barton et al., Schill, and Walker et al. with the maximum likelihood decoding of Chiason et al. since Chiasson et al. states maximum likelihood decoding improves the accuracy of decoded data. (column 1, lines 29-42).

8. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al. (U. S. Patent No. 6, 654, 431) in view of Schill (EP 1 324 558 A1) in further view of Walker et al. (US 2003/0076889) as applied to claim 14, and in further view of Noonan et al. (U. S. Patent No. 6, 049, 574).

Regarding claim 21, Barton et al., Schill, and Walker et al. do not disclose the difference between conditional probability distributions of constellation points is a Kullback-Leibler distance.

However, Noonan et al. discloses calculating a difference between probability density functions known as a Kullback-Leibler distance (Abstract and column 3, lines 44-57) to estimate a cost function for equalization. The Kullback-Leibler distance provides a minimum distance function (see Abstract). Therefore, it would have been obvious to one skilled in the art to modify the device of Barton et al., Schill, and Walker et al. to use a Kullback-Leibler distance as disclosed by Noonan et al. since Walker et al. states maximizing a minimum distance between constellation points improves bit error probability (section 0031).

Allowable Subject Matter

9. Claims 16, 22, and 25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Curtis B. Odom whose telephone number is 571-272-3046. The examiner can normally be reached on Monday- Friday, 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Curtis Odom
May 30, 2006

Khanh cong Tran 05/30/2006
Primary Examiner KHANH TRAN